Claims:

1. Process for preparing 1-octene by

a) catalytic reaction of a butadiene-containing stream with methanol to give a stream comprising at least 1-methoxy-2,7-octadiene,

b) catalytic hydrogenation of the 1-methoxy-2,7-octadiene-containing stream to give a stream comprising at least 1-methoxyoctane,

c) catalytic dissociation of at least part of the 1-methoxyoctane to give a dissociation product comprising at least water and 1-octene,

wherein

d) the dissociation product from c) is separated by distillation into a gaseous low-boiling fraction comprising at least 1-octene and water and a liquid high-boiling fraction comprising at least 1-octene and 1-methoxyoctane,

e) the low-boiling fraction is completely or partially condensed and separated into an aqueous phase and a 1-octene-containing, nonpolar phase,

f) the nonpolar phase from e) is recirculated to step d) and

g) the high-boiling fraction from d) is separated into a 1-octene-containing fraction and a 1-methoxyoctane-containing fraction.

2. The process as claimed in claim 1,

wherein

d1) the dissociation product from c) comprises dimethyl ether (DME) and is separated by distillation into a low-boiling fraction comprising at least DME and a high-boiling fraction which is at least partly passed to step d).

3. The process as claimed in claim 2,

wherein

the high-boiling fraction from d1) comprises methanol and is washed with water to give a methanol-containing aqueous stream and a nonpolar stream which is passed to step d).

4. The process as claimed in claim 1,

wherein

d2) comprises methanol as dissociation product from c) and is washed with water to give a methanol-containing, aqueous stream and a nonpolar stream which is passed at least partly to step d).

5. The process as claimed in claim 4,
wherein
the nonpolar stream comprises at least DME and is separated by distillation into a low-boiling fraction comprising at least DME and a high-boiling fraction which is passed to step d).

6. The process as claimed in any of claims 1 to 5,
wherein
the 1-octene-containing fraction from g) is separated in a step h) into a fraction comprising at least 1-octene and a fraction comprising at least C_8- and C_9-olefins.

7. The process as claimed in any of claims 1 to 6,
wherein
the 1-methoxyoctane-containing fraction from g) is separated in a step i) into a low-boiling fraction comprising 1-methoxyoctane and a high-boiling fraction comprising at least dioctyl ether.

8. The process as claimed in claim 7,
wherein
the low-boiling fraction is recirculated to step c).

9. The process as claimed in any of claims 1 to 8,
wherein
k) the step a) comprises, after the catalytic reaction, a distillation step in which the C_4-hydrocarbons are separated off by distillation and the remaining stream which has a C_4-hydrocarbon content of less than 5% by weight is passed to step b).

10. The process as claimed in any of claims 1 to 9,

wherein

l) the stream from step b) is separated by distillation into a low-boiling fraction comprising at least methanol, 3-methoxyoctane and C_8-hydrocarbons and a low-boiling fraction comprising at least 1-methoxyoctane and the high-boiling fraction is passed to step c).

11. The process as claimed in claim 3 or 4,

wherein

methanol and/or water is/are separated off from the aqueous, methanol-containing stream in a step o).

12. The process as claimed in claim 11,

wherein

the aqueous phase from e) is likewise fed to step o).

13. The process as claimed in claim 11 or 12,

wherein

the low-boiling fraction from l) is likewise fed to step o).

14. The process as claimed in any of claims 11 to 13,

wherein

an organic phase is separated off from the stream in step o) and the aqueous phase is separated by distillation into a low-boiling fraction comprising methanol and a high-boiling fraction comprising water.

15. The process as claimed in claim 14,

wherein

the organic phase is separated off by extraction.

16. The process as claimed in any of claims 11 to 15,

wherein

all or part of the methanol is recirculated to step a) (telomerization).